Remarks/Arguments:

Claim 78 has been amended. No new matter is introduced herein. Claims 78-80 and 82-85 are pending.

Claim 78 has been amended to clarify that the stable proton exchange layer is configured to be prevented from spontaneously undergoing a temporal variation in the refractive index without application of an electric field when a pseudo-phase matching condition of the stable proton exchange layer is satisfied. Claim 78 has also been amended to include the feature that a strain induced in the stable proton exchange layer during the forming of the optical wavelength conversion element is mitigated by a low-temperature annealing process after forming the optical wavelength conversion element. No new matter is introduced herein. Basis for the amendments can be found, for example, at p. 26, line 1 - p. 27, line 26; p. 30, line 30 - p. 32, line 13; and Figs. 8A - 8E and 9.

Claims 78-80 and 82-85 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamamoto et al. (U.S. Patent No. 5,303,247) in view of Rakuljic (U.S. Patent No. 5,691,989). It is respectfully submitted, however, that these claims are patentable over the cited art for the reasons set forth below.

Claim 78, as amended, includes features neither disclosed nor suggested by the cited art, namely:

> ... the stable proton exchange layer is configured to <u>prevent</u> the stable proton exchange layer from <u>spontaneously undergoing a temporal variation</u> in the refractive index <u>without application of an electric field</u> when a pseudo-phase matching condition of the stable proton exchange layer is satisfied ...
>
> ... <u>strain induced</u> in the stable proton exchange layer <u>during</u> the forming of the optical wavelength conversion element <u>is mitigated</u> by <u>a low-temperature annealing process after forming</u> the optical wavelength conversion element ... (Emphasis Added)

Yamamoto disclose, in Fig. 15, a shorter wavelength generating apparatus 51, including a semiconductor laser source 52 and an optical harmonic generating device 55 for generating a harmonic wave from a fundamental wave (col. 23, lines 33-43).

The optical harmonic generating device 55, shown in Fig. 16, includes reverse polarization layers 64 that are produced according to a proton exchange process (col. 23, line 66 - col. 24, line 16). Yamamoto et al. also disclose that when the pseudo-phase matching condition is not satisfied (where the wavelength of the fundamental wave is changed), an electric field is induced in the optical harmonic generating device to change refractive indices of the polarization layers (col. 5, lines 11-21 and col. 14, lines 4-21). When the pseudo-phase matching condition is satisfied (where the wavelength of the fundamental wave matches a standard length), no electric field is induced (col. 13, lines 3-20).

Yamamoto et al. do not disclose or suggest Applicants' claimed features that "the stable proton exchange layer is configured to prevent the stable proton exchange layer from spontaneously undergoing a temporal variation in the refractive index without application of an electric field when a pseudo-phase matching condition of the stable proton exchange layer is satisfied" (emphasis added). These features are neither disclosed nor suggested by Yamamoto et al.

On page 2 of the Office Action, the Examiner asserts that Yamamoto et al. at col. 13, lines 3-20, disclose that the wavelength of light satisfies the pseudo-phase matching conditions and "therefore does not require the application of an electric field to the conversion element, and thereby utilizes a refractive index with no temporal variation". Applicants agree that in this embodiment, because it would not be necessary to change the refractive index, a temporal variation in the refractive index may not occur. However, Yamamoto et al. teach satisfying a new pseudo-phase matching condition by varying the refractive index with application of an electric field when the pseudo-phase matching condition is not satisfied. Indeed, the skilled person would understand that, according to Yamamoto et al., changing the refractive index is not necessary when the pseudo-phase matching condition is satisfied. In contrast, Applicants' claimed invention prevents the stable proton exchange layer from spontaneously undergoing a temporal variation in the refractive index, without application of an electric field, when a pseudo-phase matching condition of a stable proton exchange layer is satisfied.

Furthermore, as shown in Figs. 10A and 10B, Yamamoto et al. do not suggest that the proton exchange layer may spontaneously undergo a temporal variation in the refractive index (also col. 17, lines 11-22). In Figs. 10A and 10B, an electric field of pulses having the same peak of electric potential (5V) is applied as a function of time. The intensity of the harmonic wave corresponding to the applied electric field pulse is constant. If there were a spontaneous temporal variation in the refractive index, the peak electric potential would be changed as a function of time, in order to change a ratio of variation in the refractive index, due to the applied electric field. However, as shown in Figs. 10A and 10B, a constant electric potential produces a constant intensity of the harmonic wave. Accordingly, Yamamoto et al., do not disclose or suggest that the refractive index may undergo a temporal variation. Thus, Yamamoto et al. cannot disclose or suggest preventing a stable proton exchange layer from spontaneously undergoing a temporal variation in the refractive index without application of an electric field, as required by claim 78.

In addition, Yamamoto et al. do not disclose or suggest Applicants' claimed features that a "strain induced in the stable proton exchange layer during the forming of the optical wavelength conversion element is mitigated by a low-temperature annealing process after forming the optical wavelength conversion element" (emphasis added). These features are neither disclosed nor suggested by Yamamoto et al. In Figs. 8A - 8E and at col. 15, line 26 - col. 16, line 41, Yamamoto et al. disclose a heating process that is performed while the wavelength conversion element is formed. For example, Yamamoto et al. disclose a first proton exchange process at a temperature of 260°C (col. 15, lines 45-51), formation of a reverse polarization layer at a temperature of 550°C (col. 15, line 59 - col. 16, line 2), a second proton exchange process at a temperature of 260°C (col. 16, lines 14-15) and formation of a non-reverse polarization layer at a temperature of 380°C (col. 16, lines 19-23). However, Yamamoto, et al. do not disclose or suggest that a low-temperature annealing process is performed after forming the optical wavelength conversion element to mitigate a strain induced in the stable proton exchange layer, as required by claim 78. Yamamoto et al. is silent regarding low-temperature annealing after formation of the optical wavelength conversion element.

In addition, the Office Action, at page 4, readily admits that Yamamoto et al. do not teach a semiconductor laser to be a distributed feedback type or that the output of the laser is to be amplified by a solid state source. Thus, Yamamoto et al. do not include all of the features of claim 78.

Rakuljic et al. disclose, in Fig. 21, a laser 90 that includes a distributed feedback (DFB) laser to pump an optical gain medium 91, "such as Er-doped optical fiber amplifiers, Er-doped fiber lasers or diode-pumped solid state lasers" (col. 17, lines 30-44). However, Rakuljic et al. do not make up for the features that are lacking in Yamamoto et al. Namely, that the stable proton exchange layer is configured to prevent the stable proton exchange layer from spontaneously undergoing a temporal variation in the refractive index without application of an electric field when a pseudo-phase matching condition is satisfied or that a strain induced in the stable proton exchange layer is mitigated by a low-temperature annealing process after forming the optical wavelength conversion element. Thus, Rakuljic et al. do not include all of the features of claim 78.

Applicants' claimed laser source includes advantages over the cited art. One of the features of the subject invention is in the preparation of the optical wavelength conversion element formed of a stable proton exchange layer. According to Applicants' invention, a stable proton exchange layer is configured to be prevented from spontaneously undergoing a temporal variation in the refractive index, without application of an electric field, when a pseudo-phase matching condition is satisfied. This configuration prevents the stable proton exchange layer from spontaneously undergoing a temporal variation in the refractive index, thereby preventing a change in the pseudo-phase wavelength due to a change that occurs in the refractive index, when a pseudo-phase matching condition is satisfied. Accordingly, a stable optical wavelength conversion element is realized, having a phase matching wavelength that does not vary with time when a pseudo-phase matching condition is satisfied. Thereby output of a laser light source that includes the optical wavelength conversion element is stabilized.

Another feature of the subject invention is that a strain induced in the stable proton exchange layer during formation of the optical wavelength conversion element

is mitigated by a low-temperature annealing process after forming the optical wavelength conversion element, such that the stable proton exchange layer is prevented from spontaneously undergoing a temporal variation in the refractive index. According to Applicants' invention, this feature prevents the stable proton layer from spontaneously undergoing a temporal variation in the refractive index, which occurs during a heat process, such as a high-temperature annealing process, that may be performed after forming the optical wavelength conversion element. Because the strain can be mitigated by a low-temperature annealing process after formation of the optical wavelength conversion element a spontaneous temporal change in the refractive index can be prevented. As discussed above, in Yamamoto et al., a strain is induced during formation of the wavelength conversion element. In practice, the wavelength conversion element of Yamamoto et al. includes the induced strain. Therefore, in contrast to the subject invention, Yamamoto et al. cannot prevent a stable proton exchange layer from spontaneously undergoing a temporal variation in the refractive index without application of an electric field, when a pseudo-phase matching condition is satisfied. These features and advantages are neither disclosed nor suggested by the cited art. Accordingly, allowance of claim 78 is respectfully requested.

Claims 79, 80 and 82-85 including all of the features of claim 78 from which they depend. Accordingly, claims 79, 80 and 82-85 are also patentable over the cited art.

In view of the amendments and arguments set forth above, the above identified application is in condition for allowance which action is respectfully requested.

Respectfully submitted,

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